

SPECIAL FORECASTS AND WARNINGS—WEATHER AND CROPS.

WEATHER WARNINGS.

By H. C. FRANKENFIELD, Supervising Forecaster.

[Dated: Weather Bureau, Washington, D. C., May 23, 1919.]

The first warning of the month was issued at 9:30 p. m., April 6. It was an advisory warning to open ports on Lake Michigan for increasing east winds, with rain or snow, on the following day. At the time there was a Colorado disturbance over western Nebraska with a northeastward movement, and strong winds and rains occurred as forecast, with also some severe thundersqualls along the northwest shore.

On the evening of the 8th a southwestern disturbance was central over Texas with a promise of further development to the eastward, and at 10 p. m. southeast storm warnings were ordered along the Gulf coast from Bay St. Louis, Miss., to Carrabelle, Fla. The subsequent movement of the disturbance was more to the northward than had been anticipated, and only fresh winds occurred on the following day. On the morning of the 9th, with the storm center over Oklahoma, advisory warnings of fresh to strong northeast to north winds were sent to open ports on Lake Michigan, and moderately strong winds occurred during the night of the 9th and on the 10th, the warnings having been repeated on the morning of the 10th. By the afternoon of the 10th the disturbance was central over Wisconsin, with a decided pressure fall to the eastward, and at 6 p. m. southwest storm warnings were ordered along the Atlantic Coast from Portland, Me., to Norfolk, Va., for strong southwest winds, to begin by the following morning. At 10:30 p. m. the warnings were extended to Eastport, Me. Strong winds occurred generally as forecast, New York City reporting a velocity of 60 miles an hour from the south on the 11th.

The display of storm warnings on the Great Lakes was resumed for the season on the 15th, and at 10 a. m. of that day northeast storm warnings were ordered for Lakes Michigan and Huron and central and western Lake Erie, and small-craft warnings for Lake Superior. At this time a disturbance that first appeared over Nevada on the morning of the 12th was central over northern Illinois, with a slow, but steady, eastward movement. At 2:30 p. m. advisory warnings for fresh and possibly moderately strong northeast winds were sent to Lake Ontario ports. Strong winds occurred as forecast, and on the morning of the 16th, with the storm center over Ohio in more marked form, northeast warnings were continued on Lake Huron from Alpena to Mackinaw City, Mich., and those on Lake Erie from Cleveland, Ohio, to Erie, Pa., changed to northwest, while southwest warnings were ordered from Buffalo to Oswego, N. Y. Southeast warnings were also ordered along the Atlantic coast from Delaware Breakwater, Del., to Portland, Me., and southwest warnings from Baltimore, Md., to Hatteras, N. C. At 3:30 p. m. northeast warnings were also ordered on extreme eastern Lake Superior, and southeast warnings at 10 p. m. on the Maine coast east of Portland. All of these warnings were justified by the subsequent occurrences.

On the morning of the 23d there was a moderate depression over the Upper Mississippi Valley and the western Upper Lake Region, with a strong and cold high area to the northwestward, and northwest warnings were ordered at 10 a. m. on Lake Superior and on Lake Michigan from Milwaukee, Wis., and Ludington, Mich., northward, strong

winds with rain possibly turning to snow being forecast. At 3:30 p. m. the northwest warnings were extended on Lake Huron from Mackinaw City to Alpena, and at 10 p. m., with the disturbance over northeastern Ohio, northwest warnings were also ordered for the balance of Lake Huron and for Lake Erie as far east as Erie, Pa. On the morning of the 24th, with the storm central over Lake Ontario, northwest warnings were ordered for that lake, and at 12 noon for the Atlantic coast from Norfolk to Boston. All of these warnings were fully verified except in the immediate vicinity of Boston.

By the morning of the 25th the storm center had reached southern Maine, and the Atlantic coast warnings were continued from Sandy Hook, N. J., to Boston, and extended northward to Eastport, Me. These warnings were also justified, except on the coast of Maine. There were no other storms during the month, and there were no storms without warnings.

COLD-WAVE AND FROST WARNINGS.

High pressure prevailed over the interior districts east of the Mississippi River on the morning of the 1st, and heavy frosts occurred as far south as the northern portions of Alabama, Georgia, and South Carolina. Frost warnings were then issued for the Southern States as far south as northern Florida and for freezing temperatures into South Carolina, and on the morning of the 2d light frost occurred as far south as central Florida, and freezing temperature to the North Carolina-South Carolina line. Warnings were again issued for freezing temperatures on the morning of the 3d in West Virginia, Virginia, Maryland, and the District of Columbia, and for frosts as far south as central Florida. These warnings were also verified as a whole, although the temperatures in the District of Columbia and eastern Maryland did not quite fall to the freezing point.

On the morning of the 10th warnings of frost, contingent upon clearing weather, were issued for the interior of the East Gulf States and central and western Tennessee, but the fall in temperature was not sufficient and no frosts occurred, although the weather cleared and frosts occurred in Arkansas.

On the morning of the 13th pressure was quite high over the lower Ohio Valley, with cool clear weather, and the forecasts for West Virginia, Virginia, and Maryland contained a warning of possible frost on the following morning. Again no frost occurred owing to the rapid eastward movement of a western depression.

The light frosts on the morning of the 17th over central Tennessee and northern Alabama were not forecast. Frosts were forecast for the morning of the 18th over southern Virginia, the Carolinas, the interior of Alabama and Mississippi, northern and central Georgia, Tennessee, Kentucky, and southern Ohio, and they occurred generally as forecast.

Frosts were also forecast for the morning of the 19th over the Ohio Valley, the lower Lake region, and the Atlantic States from southern New England to North Carolina, and the forecast was correct, except along the Atlantic coast.

Other forecasts for portions of the Atlantic States on the 20th, 21st, 25th, 26th, and 29th were also generally verified.

No cold-wave warnings were issued during the month.

SPECIAL UPPER-AIR FORECASTS.

Special forecasts of surface and upper-air conditions were made daily for the United States Army and Navy and the Post Office Department. These forecasts were found to be of great practical benefit to all concerned, and they have apparently become an established feature of the forecast work. During the month of April Maj. Theodore C. Macaulay, of the United States Army Air Service, completed a coast-to-coast flight in an aeroplane, and upon the completion thereof he forwarded the following telegram to the Chief of the Weather Bureau:

Coast-to-coast and return flight completed eleven thirty today (April 18) covering fifty-five hundred miles in five and one-half days with total flying time of forty-four hours. Sincerely appreciate your valuable cooperation.

MACAULAY.

WARNINGS FROM OTHER DISTRICTS.

Chicago, Ill., Forecast District.—The month was marked by rather frequent storm movement over the forecast district. As a consequence, the temperature was variable, but for the most part considerably above the seasonal normal during the first half of the month and below during the second half. Rainfall was frequent in the Middle States, but, while greater than the monthly normal, excessive amounts were recorded in only a few instances. The outstanding feature of the entire month was the small amount of sunshine in various portions of the district, and especially during the second half of the month.

Aside from the regular forecasts the warnings during the month were confined to advices as to probable frosts. These warnings were necessary at the beginning of the month only for southern Missouri, extreme southern Illinois, and southeastern Kansas, because the condition of vegetation in other sections had not advanced to the danger point. At the close of the month, however, this condition was reached all over the region, except in the more northerly and westerly sections.

Frost and freezing-temperature warnings were issued for Kansas on the 7th, 8th, 9th, and 10th, following the movement eastward of two well-marked low-pressure areas across the Middle States, and on the 9th for western Missouri, and again on the 10th for the entire State of Missouri, and these were almost fully verified.

On the 15th, 16th, and 17th similar warnings were issued for Kansas, on the 15th for west and central Missouri, and on the 16th and 17th for all Missouri and southern Illinois, following the movement eastward of another disturbance. These, too, were verified, with the exception of the last warning for west and central Kansas, as that State by the morning of the 18th had come under the influence of a northwestern low-pressure area, which caused a shift of the winds to southerly.

Warnings were issued on the 21st for southeastern Wisconsin and northeastern Illinois as a high-pressure area approached the Lake region from the upper Mississippi Valley, and these were fully verified. By the morning of the 23d an area of high pressure of great magnitude had developed in the Northwest, and this pushed slowly southeastward over the Middle States,

producing abnormally low temperatures over a vast area. As this condition was well marked, warnings of frost and freezing temperature were issued well in advance of the wave, and it was not until the evening of the 26th that the influence of the high terminated in the eastern portion of the forecast district.

Another high-pressure area, but of lesser magnitude than the preceding one, pushed down from Manitoba over the upper Mississippi Valley and Great Lakes region during the 27th-28th. By that time, even, vegetation in the far Northwest had not developed sufficiently to require warnings, but on the 28th advices were sent to Wisconsin, Minnesota, and northeastern Iowa, with ensuing verifications, with the exception of the portion of Iowa indicated, where cloudy weather developed.

Warnings were issued for South Dakota and Nebraska and western Kansas on the 30th in advance of another northwestern high-pressure area, but the verification of these warnings was confined to South Dakota and western and central Nebraska as the high lost intensity and was followed immediately by a barometric disturbance.

While these warnings were given wide distribution, no estimate of their value can be well determined. It is probable, however, that garden truck was protected to a large extent.

A special wind and weather forecast was sent to the observer at Helena, Mont., April 24 for Saturday the 26th, in connection with the "Flying Circus" of the United States Army aviators advertising the Fifth Liberty loan, and the prediction of fair weather with moderate winds was fortunately verified. The observer at Helena has reported that the forecast was much appreciated.—*H. J. Cox.*

New Orleans, La., Forecast District.—Storm warnings ordered 9:20 p. m., April 8, for the Texas coast, Velasco to Port Arthur, were verified.

Small-craft warnings were displayed on the Texas coast on the 6th and on the Louisiana coast on the 9th.

Cold-wave warnings displayed over central and eastern Oklahoma and northwestern Arkansas, April 9, were partially verified.

Fire-weather warnings were issued for Oklahoma and Arkansas on April 6 and were justified.—*I. M. Cline.*

Denver, Colo., Forecast District.—Warnings of frost or freezing temperature were issued on eight days during the first half of April and on four days during the latter half. The warnings were fully verified in nearly all cases. While freezing temperatures occurred in the northern half of the district, vegetation was too backward to be injured. In the latter half of the month higher temperatures prevailed and fruits made rapid progress. The frosts were light and the damage, if any, was slight.—*F. H. Brandenburg.*

San Francisco, Cal., Forecast District.—There were no severe storms during April in the San Francisco Forecast District. Temperatures averaged slightly above normal and the rainfall was deficient, except in western Oregon, western Washington, extreme northwestern California, and southwestern Idaho.

During the first decade barometric pressure was unusually low over the Aleutian Islands, and it was necessary to display storm warnings on the 3d at north Pacific coast stations and on the 5th along the northern California coast, and small-craft warnings on the 15th and 19th at northern coast stations. The Los Angeles official hoisted storm warnings on the 6th in his district, which were verified.

During the middle decade barometric pressure was unusually high over the Aleutian Islands, which resulted for the most part in fair weather in this district. There were numerous frosty mornings in the North Pacific States and on two or three mornings frost formed in northern California. Warnings for same were issued in every instance.

RIVERS AND FLOODS, APRIL, 1919.

ALFRED J. HENRY, Meteorologist in Charge.

Floods on the Atlantic drainage.—Owing to the light snow cover and the absence of torrential rains, there were no destructive floods in this region during the month. In New England the Connecticut River reached flood stage at two points only, viz, White River Junction, Vermont and Hartford, Conn. The rivers of the South Atlantic States did not reach flood stage, except on the Santee, where a moderate flood prevailed about the middle of the month below the junction of the Wateree and the Congaree. The details are shown in Table I.

East Gulf drainage.—In this district, likewise, only light local floods were recorded. The Tombigbee River of Alabama was above the flood stage on April 2: the Pearl River of Mississippi was above flood stage on April 19. No material damage resulted.

West Gulf drainage.—The upper Trinity was in flood on several days of the month, and the Rio Grande in New Mexico reached flood stage during the last decade of the month.

Mississippi drainage—Mississippi River.—For the third consecutive year there has been no flood of consequence in the Mississippi below Cairo and only light to moderate floods above St. Louis. Agricultural lands along that portion of the stream between Davenport, Iowa, and Louisiana, Mo., suffered more or less by overflow in 1915, 1916, and 1918. In 1918 the Indian Grave Levee broke at a stage of 17.4 feet on the Quincy, Ill., gage. Since a stage of 17.5 feet was reached at Quincy on April 28, much apprehension was felt for the safety of the levees and radical measures were taken to reinforce weak spots.

The natural conditions favorable to high water in this section of the Mississippi are the occurrence of heavy rains extending over two or three days in eastern Iowa or moderate rains extending over a longer period, the run-off from which may or may not synchronize with that from melting snow or heavy rain on the Mississippi drainage above Dubuque, Iowa. The magnitude of the floods will depend largely upon the simultaneity of the run-off from the two regions. The rainfall of the current season has caused high water quite generally in eastern Iowa rivers and along the Mississippi from Dubuque, Iowa, to Louisiana, Mo. The slope of the Mississippi in the stretch from Quincy, Ill., to Louisiana, Mo., is small; therefore flood waters run off slowly. Following is a summary of duration of flood stages taken from Table IV.

Station.	From—	To—
Keokuk, Iowa.....	Apr. 21	Continued at end of month.
Warsaw, Ill.....	Apr. 22	Do.
Quincy, Ill.....	Apr. 18	Do.
Hannibal, Mo.....	Apr. 13	Do.
Louisiana, Mo.....	Apr. 17	Do.

Along the stretch of the river represented by the above-named stations, farming the rich bottom lands is a more

or less hazardous proposition. Yet, by reason of the great fertility of the soil, the incentive to take the risk of loss by overflow is so compelling that, except for such times as an early overflow prevents the putting in of crops, the lands are always under cultivation.

The Mississippi below Cairo was at flood stage on the first of the month between Memphis and Arkansas City, Ark. The crest of this rise reached Vicksburg, Miss., on the 15th, and passed thence slowly down stream as a moderate freshet. The only overflow so far recorded was that of about 400 square miles in Mississippi, mostly between the Yazoo and Mississippi rivers.

The lower stretches of the Illinois River were in flood the entire month; that portion above Peoria from the 1st to the 15th. Timely warnings were issued in all cases.

Approximate loss by floods, April, 1919.

District.	Tangible property.	Crops.		Live stock.	Suspension of business.	Money value of warnings.
		Present.	Prospective.			
Davenport, Iowa.....	\$20,000				\$2,500	\$12,000
Vicksburg, Miss.....			\$40,000			

TABLE I.—Flood stages in the Atlantic drainage during the month of April, 1919.

River and station.	Flood stage.	Above flood stages—dates.		Crest.	
		From—	To—	Stage.	Date.
<i>Connecticut:</i>	<i>Feet.</i>			<i>Feet.</i>	
White River Junction, Vt.....	13	12	16	15.5	14
Hartford, Conn.....	16	(**)	1	19.8	†30
<i>Hudson:</i>					
Albany, N. Y.....	12			10.9	13
<i>West Canada Creek:</i>					
Trenton Falls, N. Y.....	8			7.5	12
<i>Santee:</i>					
Rimini, S. C.....	12	14	17	12.5	15
Ferguson, S. C.....	12	16	20	12.2	17-19

** Continued from March.

† March.

TABLE II.—Flood stages in the East Gulf drainage during the month of April, 1919.

River and station.	Flood stage.	Above flood stages—dates.		Crest.	
		From—	To—	Stage.	Date.
<i>Tombigbee:</i>	<i>Feet.</i>			<i>Feet.</i>	
Demopolis, Ala.....	39	(**)	2	44.1	1
<i>Pearl:</i>					
Jackson, Miss.....	20	19	21	21.0	20
Columbia, Miss.....	18			17.9	19
<i>West Pearl:</i>					
Pearl River, La.....	13	{ (**)	8	14.9	†27
		16	27	14.3	23

** Continued from March.

† March.